

# CDx4HC534, CDx4HCT534, CDx4HC564, CDx4HCT564 High-Speed CMOS Logic Octal D-Type Flip-Flop, Three-State Inverting Positive-Edge Triggered

## 1 Features

- Buffered inputs
- Common three-state output-enable control
- Three-state outputs
- Bus line driving capability
- Typical propagation delay = 13 ns at  $V_{CC} = 5$  V,  $C_L = 15$  pF,  $T_A = 25^\circ\text{C}$  (clock to output)
- Fanout (over temperature range)
  - Standard outputs: 10 LSTTL loads
  - Bus driver outputs: 15 LSTTL loads
- Wide operating temperature range:  $-55^\circ\text{C}$  to  $125^\circ\text{C}$
- Balanced propagation delay and transition times
- Significant power reduction compared to LSTTL Logic ICs
- HC types
  - 2 V to 6 V operation
  - High noise immunity:  $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$  at  $V_{CC} = 5$  V
- HCT types
  - 4.5 V to 5.5 V operation
  - Direct LSTTL input logic compatibility,  $V_{IL} = 0.8$  V (max),  $V_{IH} = 2$  V (min)
  - CMOS input compatibility,  $I_I \leq 1 \mu\text{A}$  at  $V_{OL}, V_{OH}$

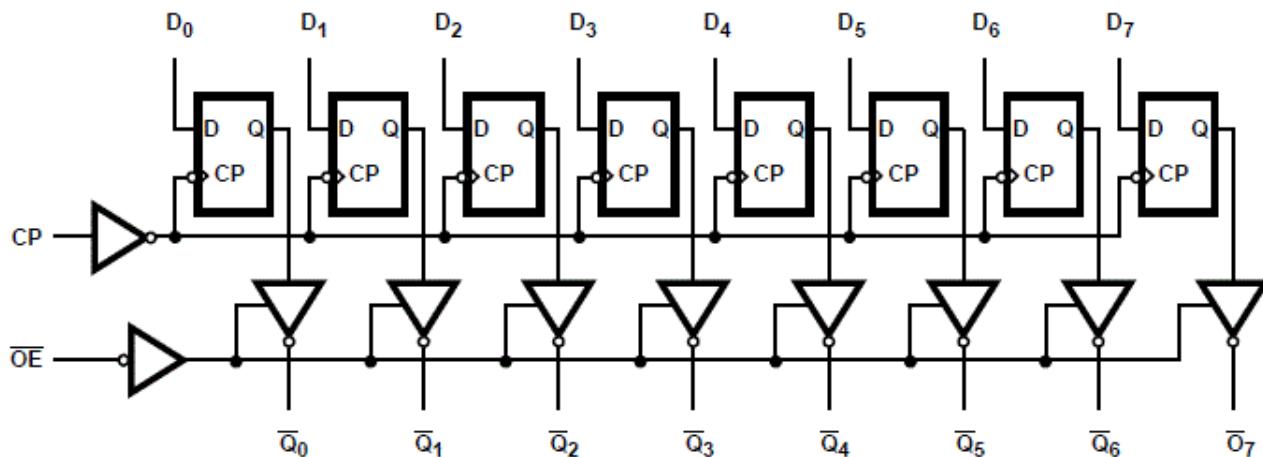
## 2 Description

The 'HC534, 'HCT534, 'HC564, and 'HCT564 are high speed Octal D-Type Flip-Flops manufactured with silicon gate CMOS technology. They possess the low power consumption of standard CMOS integrated circuits, as well as the ability to drive 15 LSTTL loads. Due to the large output drive capability and the three-state feature, these devices are ideally suited for interfacing with bus lines in a bus organized system. The two types are functionally identical and differ only in their pinout arrangements.

### Device Information

| PART NUMBER   | PACKAGE <sup>(1)</sup> | BODY SIZE (NOM)    |
|---------------|------------------------|--------------------|
| CD74HC564M    | SOIC (20)              | 12.80 mm × 7.50 mm |
| CD74HCT564M   | SOIC (20)              | 12.80 mm × 7.50 mm |
| CD74HC534E    | PDIP (20)              | 25.40 mm × 6.35 mm |
| CD74HC564E    | PDIP (20)              | 25.40 mm × 6.35 mm |
| CD74HCT534E   | PDIP (20)              | 25.40 mm × 6.35 mm |
| CD74HCT564E   | PDIP (20)              | 25.40 mm × 6.35 mm |
| CD54HC534F3A  | CDIP (20)              | 26.92 mm × 6.92 mm |
| CD54HCT534F3A | CDIP (20)              | 26.92 mm × 6.92 mm |
| CD54HCT564F3A | CDIP (20)              | 26.92 mm × 6.92 mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet



Functional Diagram



An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

## Table of Contents

|   |           |  |           |
|---|-----------|--|-----------|
| <b>1 Features</b> .....                             | <b>1</b>  | 7.2 Functional Block Diagram.....  | <b>10</b> |
| <b>2 Description</b> .....                          | <b>1</b>  | 7.3 Device Functional Modes.....   | <b>10</b> |
| <b>3 Revision History</b> .....                     | <b>2</b>  | <b>8 Power Supply Recommendations</b> .....                                | <b>11</b> |
| <b>4 Pin Configuration and Functions</b> .....      | <b>3</b>  | <b>9 Layout</b> .....  | <b>11</b> |
| <b>5 Specifications</b> .....                       | <b>4</b>  | 9.1 Layout Guidelines.....   | <b>11</b> |
| 5.1 Absolute Maximum Ratings <sup>(1)</sup> .....   | 4         | <b>10 Device and Documentation Support</b> .....                           | <b>12</b> |
| 5.2 Recommended Operating Conditions .....          | 4         | 10.1 Receiving Notification of Documentation Updates..                     | <b>12</b> |
| 5.3 Thermal Information.....                        | 4         | 10.2 Support Resources.....  | <b>12</b> |
| 5.4 Electrical Characteristics.....                 | 5         | 10.3 Trademarks.....   | <b>12</b> |
| 5.5 Prerequisite for Switching Characteristics..... | 6         | 10.4 Electrostatic Discharge Caution.....                                  | <b>12</b> |
| 5.6 Switching Characteristics.....                  | 7         | 10.5 Glossary.....   | <b>12</b> |
| <b>6 Parameter Measurement Information</b> .....    | <b>8</b>  | <b>11 Mechanical, Packaging, and Orderable</b><br><b>Information</b> ..... | <b>12</b> |
| <b>7 Detailed Description</b> .....                 | <b>10</b> |  |           |
| 7.1 Overview.....                                   | 10        |  |           |

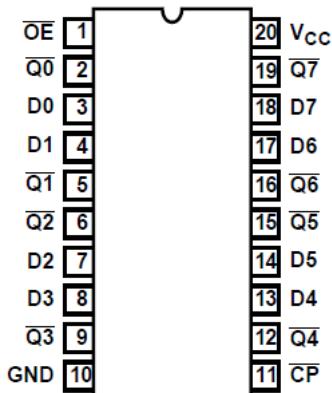
## 3 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

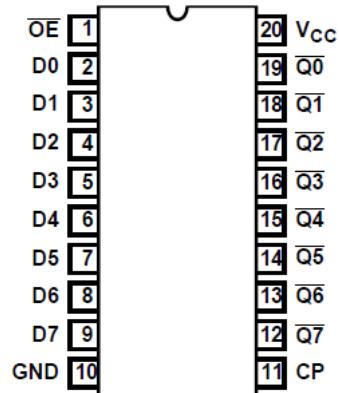
| <b>Changes from Revision D (January 2022) to Revision E (October 2022)</b> | <b>Page</b> |
|--|-------------|
| • Increased R0JA for packages: DW (58 to 109.1); N (69 to 84.6).....       | <b>4</b>    |

| <b>Changes from Revision C (April 2004) to Revision D (January 2022)</b>   | <b>Page</b> |
|--|-------------|
| • Updated the numbering, formatting, tables, figures, and cross-references throughout the document to reflect modern data sheet standards..... | <b>1</b>    |

## 4 Pin Configuration and Functions



**HC/HCT534**  
 J or N package  
 20-Pin CDIP or PDIP  
 Top View



**HC/HCT564**  
 J, N, or DW package  
 20-Pin CDIP, PDIP, or SOIC  
 Top View

## 5 Specifications

### 5.1 Absolute Maximum Ratings<sup>(1)</sup>

|                  |  |   | MIN  | MAX | UNIT |
|------------------|--|---|------|-----|------|
| V <sub>CC</sub>  | Supply voltage   |   | -0.5 | 7   | V    |
| I <sub>IK</sub>  | Input diode current                                      | For V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V |      | ±20 | mA   |
| I <sub>OK</sub>  | Output diode current                                     | For V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V |      | ±20 | mA   |
| I <sub>O</sub>   | Drain current, per output                                | For -0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V                   |      | ±35 | mA   |
| I <sub>O</sub>   | Output source or sink current per output pin             | For V <sub>O</sub> > -0.5 V or V <sub>O</sub> < V <sub>CC</sub> + 0.5 V |      | ±25 | mA   |
|                  | Continuous current through V <sub>CC</sub> or GND        |   |      | ±50 | mA   |
| T <sub>J</sub>   | Junction temperature                                     |   |      | 150 | °C   |
| T <sub>stg</sub> | Storage temperature range                                |   | -65  | 150 | °C   |
|                  | Lead temperature (Soldering 10s) (SOIC - lead tips only) |   |      | 300 | °C   |

(1) Stresses above those listed in “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### 5.2 Recommended Operating Conditions

|                                 |                          |           | MIN | MAX             | UNIT |
|---------------------------------|--------------------------|-----------|-----|-----------------|------|
| V <sub>CC</sub>                 | Supply voltage range     | HC types  | 2   | 6               | V    |
|                                 |                          | HCT types | 4.5 | 5.5             |      |
| V <sub>I</sub> , V <sub>O</sub> | Input or output voltage  |           | 0   | V <sub>CC</sub> | V    |
| t <sub>l</sub>                  | Input rise and fall time | 2 V       |     | 1000            | ns   |
|                                 |                          | 4.5 V     |     | 500             |      |
|                                 |                          | 6 V       |     | 400             |      |
| T <sub>A</sub>                  | Temperature range        |           | -55 | 125             | °C   |

### 5.3 Thermal Information

| THERMAL METRIC         |   | DW (SOIC) | N (PDIP) | UNIT |
|------------------------|---|-----------|----------|------|
|                        |   | 20 PINS   | 20 PINS  |      |
| R <sub>θJA</sub>       | Junction-to-ambient thermal resistance <sup>(1)</sup> | 109.1     | 84.6     | °C/W |
| R <sub>θJC (top)</sub> | Junction-to-case (top) thermal resistance             | 76        | 72.5     | °C/W |
| R <sub>θJB</sub>       | Junction-to-board thermal resistance                  | 77.6      | 65.3     | °C/W |
| Ψ <sub>JT</sub>        | Junction-to-top characterization parameter            | 51.5      | 55.3     | °C/W |
| Ψ <sub>JB</sub>        | Junction-to-board characterization parameter          | 77.1      | 65.2     | °C/W |
| R <sub>θJC (bot)</sub> | Junction-to-case (bottom) thermal resistance          | N/A       | N/A      | °C/W |

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC package thermal metrics](#) application report.

## 5.4 Electrical Characteristics

| PARAMETER        | TEST CONDITIONS <sup>(2)</sup> | V <sub>CC</sub> (V)                      | 25°C       |      |      | –40°C to 85°C |      | –55°C to 125°C |      | UNIT |
|------------------|--------------------------------|--|------------|------|------|---------------|------|----------------|------|------|
|                  |                                |  | MIN        | TYP  | MAX  | MIN           | MAX  | MIN            | MAX  |      |
| <b>HC TYPES</b>  |                                |  |            |      |      |               |      |                |      |      |
| V <sub>IH</sub>  | High level input voltage       |  | 2          | 1.5  |      | 1.5           |      | 1.5            |      | V    |
|                  |                                |  | 4.5        | 3.15 |      | 3.15          |      | 3.15           |      |      |
|                  |                                |  | 6          | 4.2  |      | 4.2           |      | 4.2            |      |      |
| V <sub>IL</sub>  | Low level input voltage        |  | 2          |      | 0.5  |               | 0.5  |                | 0.5  | V    |
|                  |                                |  | 4.5        |      | 1.35 |               | 1.35 |                | 1.35 |      |
|                  |                                |  | 6          |      | 1.8  |               | 1.8  |                | 1.8  |      |
| V <sub>OH</sub>  | High level output voltage      | I <sub>OH</sub> = –20 µA                 | 2          | 1.9  |      | 1.9           |      | 1.9            |      | V    |
|                  |                                | I <sub>OH</sub> = –20 µA                 | 4.5        | 4.4  |      | 4.4           |      | 4.4            |      |      |
|                  |                                | I <sub>OH</sub> = –20 µA                 | 6          | 5.9  |      | 5.9           |      | 5.9            |      |      |
|                  | High level output voltage      | I <sub>OH</sub> = –6 mA                  | 4.5        | 3.98 |      | 3.84          |      | 3.7            |      | V    |
|                  |                                | I <sub>OH</sub> = –7.8 mA                | 6          | 5.48 |      | 5.34          |      | 5.2            |      |      |
| V <sub>OL</sub>  | Low level output voltage       | I <sub>OL</sub> = 20 µA                  | 2          |      | 0.1  |               | 0.1  |                | 0.1  | V    |
|                  |                                | I <sub>OL</sub> = 20 µA                  | 4.5        |      | 0.1  |               | 0.1  |                | 0.1  |      |
|                  |                                | I <sub>OL</sub> = 20 µA                  | 6          |      | 0.1  |               | 0.1  |                | 0.1  |      |
|                  | Low level output voltage       | I <sub>OL</sub> = 6 mA                   | 4.5        |      | 0.26 |               | 0.33 |                | 0.4  | V    |
|                  |                                | I <sub>OL</sub> = 7.8 mA                 | 6          |      | 0.26 |               | 0.33 |                | 0.4  |      |
| I <sub>I</sub>   | Input leakage current          | V <sub>I</sub> = V <sub>CC</sub> or GND  | 6          |      | ±0.1 |               | ±1   |                | ±1   | µA   |
| I <sub>CC</sub>  | Supply current                 | V <sub>I</sub> = V <sub>CC</sub> or GND  | 6          |      | 8    |               | 80   |                | 160  | µA   |
| I <sub>OZ</sub>  | Three-state leakage current    | V <sub>O</sub> = V <sub>CC</sub> or GND  | 6          |      | ±0.5 |               | ±5.0 |                | ±10  | µA   |
| <b>HCT TYPES</b> |                                |  |            |      |      |               |      |                |      |      |
| V <sub>IH</sub>  | High level input voltage       |  | 4.5 to 5.5 | 2    |      | 2             |      | 2              |      | V    |
| V <sub>IL</sub>  | Low level input voltage        |  | 4.5 to 5.5 |      | 0.8  |               | 0.8  |                | 0.8  | V    |
| V <sub>OH</sub>  | High level output voltage      | V <sub>OH</sub> = –20 µA                 | 4.5        | 4.4  |      | 4.4           |      | 4.4            |      | V    |
|                  | High level output voltage      | V <sub>OH</sub> = –6 mA                  | 4.5        | 3.98 |      | 3.84          |      | 3.7            |      |      |
| V <sub>OL</sub>  | Low level output voltage       | V <sub>OL</sub> = 20 µA                  | 4.5        |      | 0.1  |               | 0.1  |                | 0.1  | V    |
|                  | Low level output voltage       | V <sub>OL</sub> = 6 mA                   | 4.5        |      | 0.26 |               | 0.33 |                | 0.4  |      |
| I <sub>I</sub>   | Input leakage current          | V <sub>I</sub> = V <sub>CC</sub> and GND | 5.5        |      | ±0.1 |               | ±1   |                | ±1   | µA   |
| I <sub>CC</sub>  | Supply current                 | V <sub>I</sub> = V <sub>CC</sub> and GND | 5.5        |      | 8    |               | 80   |                | 160  | µA   |
| I <sub>OZ</sub>  | Three-state leakage current    | V <sub>O</sub> = V <sub>CC</sub> or GND  | 5.5        |      | ±0.5 |               | ±5.0 |                | ±10  | µA   |

## 5.4 Electrical Characteristics (continued)

| PARAMETER                      |   | TEST CONDITIONS <sup>(2)</sup>              | V <sub>CC</sub> (V) | 25°C |     |     | –40°C to 85°C |       | –55°C to 125°C |       | UNIT |
|--------------------------------|---|---|---------------------|------|-----|-----|---------------|-------|----------------|-------|------|
|                                |   |   |                     | MIN  | TYP | MAX | MIN           | MAX   | MIN            | MAX   |      |
| $\Delta I_{CC}$ <sup>(1)</sup> | Additional supply current per input pin | D0 - D7 inputs held at V <sub>CC</sub> –2.1 | 4.5 to 5.5          |      | 100 | 54  |               | 67.5  |                | 73.5  | µA   |
|                                |   | CP input held at V <sub>CC</sub> –2.1       | 4.5 to 5.5          |      | 100 | 108 |               | 135   |                | 147   |      |
|                                |   | OE input held at V <sub>CC</sub> –2.1       | 4.5 to 5.5          |      | 100 | 198 |               | 247.5 |                | 269.5 |      |

(1) For dual-supply systems theoretical worst case (V<sub>I</sub> = 2.4 V, V<sub>CC</sub> = 5.5 V) specification is 1.8 mA.

(2) V<sub>I</sub> = V<sub>IH</sub> or V<sub>IL</sub>.

## 5.5 Prerequisite for Switching Characteristics

| PARAMETER        |                                  | V <sub>CC</sub> (V) | 25°C |     |     | –40°C to 85°C |     |     | –55°C to 125°C |     |     | UNIT |
|------------------|----------------------------------|---------------------|------|-----|-----|---------------|-----|-----|----------------|-----|-----|------|
|                  |                                  |                     | MIN  | TYP | MAX | MIN           | TYP | MAX | MIN            | TYP | MAX |      |
| <b>HC TYPES</b>  |                                  |                     |      |     |     |               |     |     |                |     |     |      |
| $f_{MAX}$        | Maximum clock frequency          | 2                   | 6    |     |     | 5             |     |     | 4              |     |     | MHz  |
|                  |                                  | 4.5                 | 30   |     |     | 25            |     |     | 20             |     |     |      |
|                  |                                  | 6                   | 35   |     |     | 29            |     |     | 23             |     |     |      |
| $t_W$            | Clock pulse width                | 2                   | 80   |     |     | 100           |     |     | 120            |     |     | ns   |
|                  |                                  | 4.5                 | 16   |     |     | 20            |     |     | 24             |     |     |      |
|                  |                                  | 6                   | 14   |     |     | 17            |     |     | 20             |     |     |      |
| $t_{SU}$         | Setup time data to clock         | 2                   | 60   |     |     | 75            |     |     | 90             |     |     | ns   |
|                  |                                  | 4.5                 | 12   |     |     | 15            |     |     | 18             |     |     |      |
|                  |                                  | 6                   | 10   |     |     | 13            |     |     | 15             |     |     |      |
| $t_H$            | Hold time data to clock          | 2                   | 5    |     |     | 5             |     |     | 5              |     |     | ns   |
|                  |                                  | 4.5                 | 5    |     |     | 5             |     |     | 5              |     |     |      |
|                  |                                  | 6                   | 5    |     |     | 5             |     |     | 5              |     |     |      |
| <b>HCT TYPES</b> |                                  |                     |      |     |     |               |     |     |                |     |     |      |
| $f_{MAX}$        | Maximum clock frequency          | 4.5                 | 25   |     |     | 20            |     |     | 16             |     |     | MHz  |
| $t_W$            | Clock pulse width                | 4.5                 | 20   |     |     | 25            |     |     | 30             |     |     | ns   |
| $t_{SU}$         | Setup time data to clock         | 4.5                 | 20   |     |     | 25            |     |     | 30             |     |     | ns   |
| $t_H$            | Hold time<br>Data to clock (534) | 4.5                 | 5    |     |     | 5             |     |     | 5              |     |     | ns   |
| $t_H$            | Hold time<br>Data to clock (564) | 4.5                 | 3    |     |     | 3             |     |     | 3              |     |     | ns   |

## 5.6 Switching Characteristics

$C_L = 50 \text{ pF}$ , Input  $t_r, t_f = 6 \text{ ns}$

| PARAMETER                           | V <sub>CC</sub> (V)                              | 25°C |                   |     | −40°C to 85°C |     | −55°C to 125°C |     | UNIT |
|-------------------------------------|--|------|-------------------|-----|---------------|-----|----------------|-----|------|
|                                     |  | MIN  | TYP               | MAX | MIN           | MAX | MIN            | MAX |      |
| <b>HC TYPES</b>                     |  |      |                   |     |               |     |                |     |      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Propagation delay clock to output                | 2    |                   | 165 |               | 205 |                | 250 | ns   |
|                                     |  | 4.5  | 13 <sup>(3)</sup> | 33  |               | 41  |                | 50  |      |
|                                     |  | 6    |                   | 28  |               | 35  |                | 43  |      |
| t <sub>PL</sub> , t <sub>PHZ</sub>  | Output disable to Q (534)                        | 2    |                   | 150 |               | 190 |                | 225 | ns   |
|                                     |  | 4.5  | 12 <sup>(3)</sup> | 30  |               | 38  |                | 45  |      |
|                                     |  | 6    |                   | 26  |               | 33  |                | 38  |      |
| t <sub>PLZ</sub> , t <sub>PHZ</sub> | Output disable to Q (564)                        | 2    |                   | 135 |               | 170 |                | 205 | ns   |
|                                     |  | 4.5  | 12 <sup>(3)</sup> | 27  |               | 34  |                | 41  |      |
|                                     |  | 6    |                   | 23  |               | 29  |                | 35  |      |
| t <sub>PZL</sub> , t <sub>PZH</sub> | Output enable to Q                               | 2    |                   | 150 |               | 190 |                | 225 | ns   |
|                                     |  | 4.5  | 12 <sup>(3)</sup> | 30  |               | 38  |                | 45  |      |
|                                     |  | 6    |                   | 26  |               | 33  |                | 38  |      |
| f <sub>MAX</sub>                    | Maximum clock frequency                          | 5    | 60 <sup>(4)</sup> |     |               |     |                |     | MHz  |
| t <sub>THL</sub> , t <sub>TLH</sub> | Output transition time                           | 2    |                   | 60  |               | 75  |                | 90  | ns   |
|                                     |  | 4.5  |                   | 12  |               | 15  |                | 18  |      |
|                                     |  | 6    |                   | 10  |               | 13  |                | 15  |      |
| C <sub>I</sub>                      | Input capacitance                                |      | 10                | 10  |               | 10  |                | 10  | pF   |
| C <sub>O</sub>                      | Three-state output capacitance                   |      | 20                | 20  |               | 20  |                | 20  | pF   |
| C <sub>PD</sub>                     | Power dissipation capacitance <sup>(1) (2)</sup> | 5    | 32                |     |               |     |                |     | pF   |
| <b>HCT TYPES</b>                    |  |      |                   |     |               |     |                |     |      |
| t <sub>PHL</sub> , t <sub>PLH</sub> | Propagation delay clock to output                | 4.5  | 14 <sup>(3)</sup> | 35  |               | 44  |                | 53  | ns   |
| t <sub>PLZ</sub> , t <sub>PHZ</sub> | Output disable to Q                              | 4.5  | 12 <sup>(3)</sup> | 30  |               | 38  |                | 45  | ns   |
| t <sub>PHL</sub> , t <sub>PZH</sub> | Output enable to Q                               | 4.5  | 14 <sup>(3)</sup> | 35  |               | 44  |                | 53  | ns   |
| f <sub>MAX</sub>                    | Maximum clock frequency                          | 5    | 50 <sup>(4)</sup> |     |               |     |                |     | MHz  |
| t <sub>TLH</sub> , t <sub>THL</sub> | Output transition time                           | 4.5  |                   | 12  |               | 15  |                | 18  | ns   |
| C <sub>I</sub>                      | Input capacitance                                |      | 10                | 10  |               | 10  |                | 10  | pF   |
| C <sub>O</sub>                      | Three-state output capacitance                   |      | 20                | 20  |               | 20  |                | 20  | pF   |
| C <sub>PD</sub>                     | Power dissipation capacitance <sup>(1) (2)</sup> | 5    | 36                |     |               |     |                |     | pF   |

(1) C<sub>PD</sub> is used to determine the dynamic power consumption, per package.

(2) P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup> f<sub>i</sub> + Σ C<sub>L</sub> V<sub>CC</sub><sup>2</sup> f<sub>O</sub> where f<sub>i</sub> = input frequency, f<sub>O</sub> = output frequency, C<sub>L</sub> = output load capacitance, V<sub>CC</sub> = supply voltage.

(3) C<sub>L</sub> = 15 pF and V<sub>CC</sub> = 5 V.

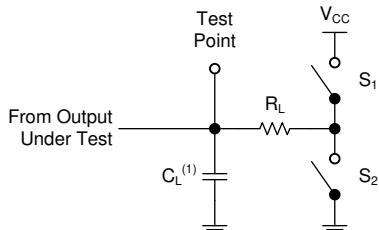
(4) C<sub>L</sub> = 15 pF.

## 6 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  1 MHz,  $Z_O = 50 \Omega$ ,  $t_t < 6$  ns.

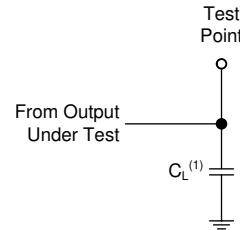
For clock inputs,  $f_{max}$  is measured when the input duty cycle is 50%.

The outputs are measured one at a time with one input transition per measurement.



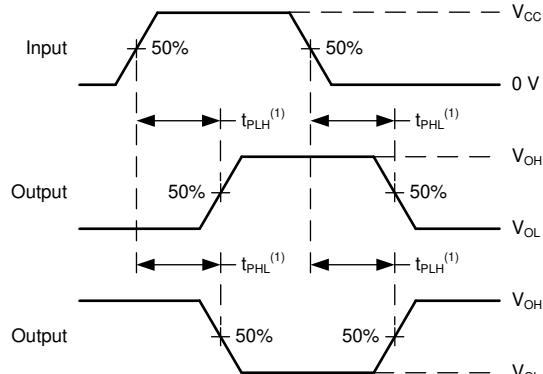
(1)  $C_L$  includes probe and test-fixture capacitance.

**Figure 6-1. Load Circuit for 3-State Outputs**



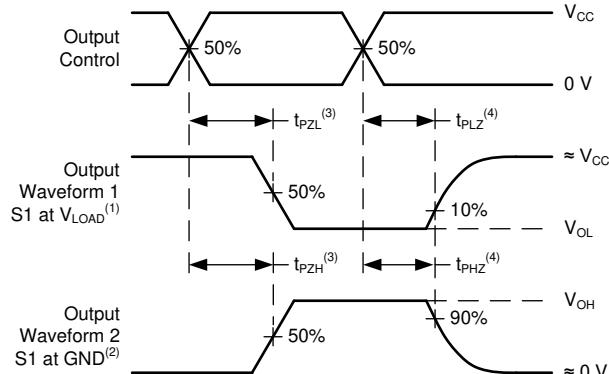
(1)  $C_L$  includes probe and test-fixture capacitance.

**Figure 6-2. Load Circuit for Push-Pull Outputs**



(1) The greater between  $t_{PLH}$  and  $t_{PHL}$  is the same as  $t_{pd}$ .

**Figure 6-3. Voltage Waveforms, Propagation Delays for Standard CMOS Inputs**



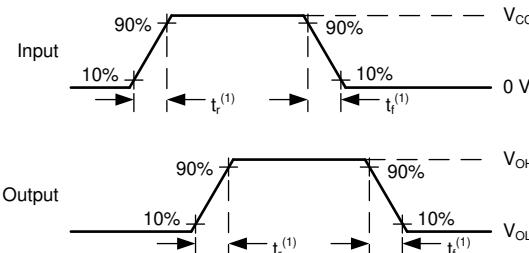
(1) S1 = CLOSED; S2 = OPEN.

(2) S1 = OPEN; S2 = CLOSED.

(3)  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .

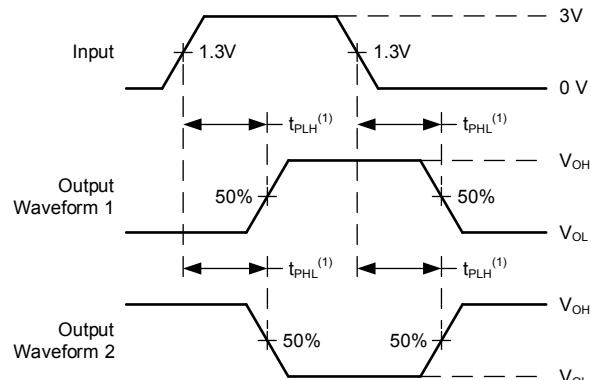
(4)  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .

**Figure 6-4. Voltage Waveforms, Standard CMOS Inputs Propagation Delays**



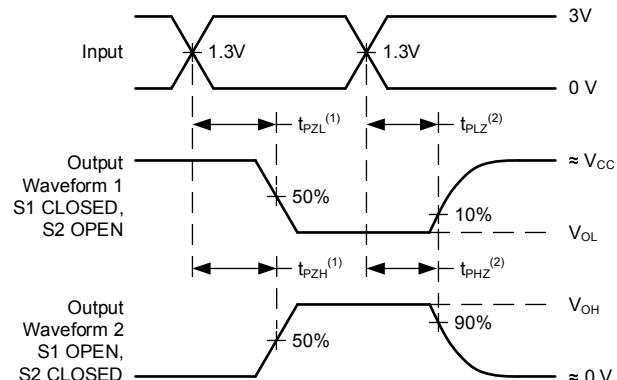
(1) The greater between  $t_r$  and  $t_f$  is the same as  $t_t$ .

**Figure 6-5. Voltage Waveforms, Input and Output Transition Times for Standard CMOS Inputs**



(1) The greater between  $t_{PLH}$  and  $t_{PHL}$  is the same as  $t_{pd}$ .

**Figure 6-6. Voltage Waveforms, Propagation Delays for TTL-Compatible Inputs**



(1)  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .

(2)  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .

**Figure 6-7. Voltage Waveforms, TTL-Compatible CMOS Inputs Propagation Delays**

## 7 Detailed Description

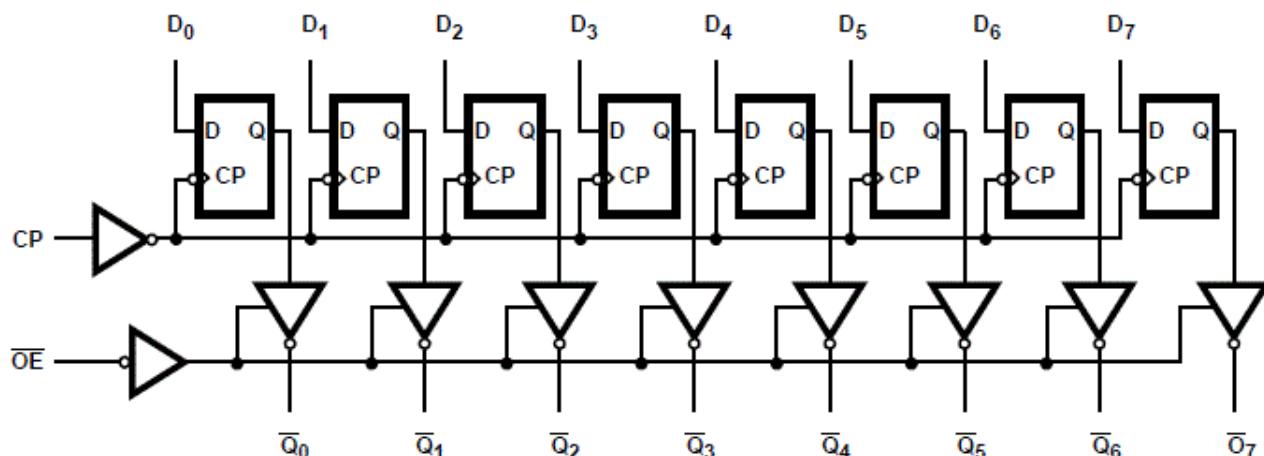
### 7.1 Overview

The 'HC534, 'HCT534, 'HC564, and 'HCT564 are high speed Octal D-Type Flip-Flops manufactured with silicon gate CMOS technology. They possess the low power consumption of standard CMOS integrated circuits, as well as the ability to drive 15 LSTTL loads. Due to the large output drive capability and the three-state feature, these devices are ideally suited for interfacing with bus lines in a bus organized system. The two types are functionally identical and differ only in their pinout arrangements.

The 'HC534, 'HCT534, 'HC564, and 'HCT564 are positive edge triggered flip-flops. Data at the D inputs, meeting the setup and hold time requirements, are inverted and transferred to the Q outputs on the positive going transition of the CLOCK input. When a high logic level is applied to the OUTPUT ENABLE input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.

The HCT logic family is speed, function, and pin compatible with the standard LS logic family.

### 7.2 Functional Block Diagram



### 7.3 Device Functional Modes

Table 7-1. Truth Table<sup>(1)</sup>

| INPUTS |    |                | OUTPUT      |
|--------|----|----------------|-------------|
| OE     | CP | D <sub>n</sub> | $\bar{Q}_n$ |
| L      | ↑  | H              | L           |
| L      | ↑  | L              | H           |
| L      | L  | X              | No change   |
| H      | X  | X              | Z           |

(1) H = high level (steady state), L = low level (steady state),  
 X = don't care, ↑ = transition from low to high level, Z = High  
 impedance state

## 8 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. A 0.1- $\mu$ F capacitor is recommended for this device. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. The 0.1- $\mu$ F and 1- $\mu$ F capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

## 9 Layout

### 9.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices, inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or  $V_{CC}$ , whichever makes more sense for the logic function or is more convenient.

## 10 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

### 10.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 10.2 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

### 10.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 10.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 10.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

| Orderable part number | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)             |
|-----------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------------------|
| 5962-8681401RA        | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8681401RA<br>CD54HC534F3A  |
| 5962-8681501RA        | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8681501RA<br>CD54HC564F3A  |
| 5962-8984901RA        | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8984901RA<br>CD54HCT534F3A |
| CD54HC534F3A          | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8681401RA<br>CD54HC534F3A  |
| CD54HC534F3A.A        | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8681401RA<br>CD54HC534F3A  |
| CD54HC564F3A          | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8681501RA<br>CD54HC564F3A  |
| CD54HC564F3A.A        | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8681501RA<br>CD54HC564F3A  |
| CD54HCT534F3A         | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8984901RA<br>CD54HCT534F3A |
| CD54HCT534F3A.A       | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 5962-8984901RA<br>CD54HCT534F3A |
| CD54HCT564F3A         | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HCT564F3A                   |
| CD54HCT564F3A.A       | Active        | Production           | CDIP (J)   20  | 20   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | CD54HCT564F3A                   |
| CD74HC534E            | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC534E                      |
| CD74HC534E.A          | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC534E                      |
| CD74HC564E            | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC564E                      |
| CD74HC564E.A          | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HC564E                      |
| CD74HC564M            | Active        | Production           | SOIC (DW)   20 | 25   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC564M                          |
| CD74HC564M.A          | Active        | Production           | SOIC (DW)   20 | 25   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC564M                          |
| CD74HC564M96          | Active        | Production           | SOIC (DW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC564M                          |
| CD74HC564M96.A        | Active        | Production           | SOIC (DW)   20 | 2000   LARGE T&R      | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HC564M                          |
| CD74HCT534E           | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT534E                     |
| CD74HCT534E.A         | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT534E                     |
| CD74HCT564E           | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT564E                     |

| Orderable part number       | Status<br>(1) | Material type<br>(2) | Package   Pins | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6) |
|-----------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| CD74HCT564E.A               | Active        | Production           | PDIP (N)   20  | 20   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -55 to 125   | CD74HCT564E         |
| <a href="#">CD74HCT564M</a> | Active        | Production           | SOIC (DW)   20 | 25   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT564M             |
| CD74HCT564M.A               | Active        | Production           | SOIC (DW)   20 | 25   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT564M             |
| CD74HCT564MG4               | Active        | Production           | SOIC (DW)   20 | 25   TUBE             | Yes         | NIPDAU                               | Level-1-260C-UNLIM                | -55 to 125   | HCT564M             |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

#### OTHER QUALIFIED VERSIONS OF CD54HC534, CD54HC564, CD54HCT534, CD54HCT564, CD74HC534, CD74HC564, CD74HCT534, CD74HCT564 :

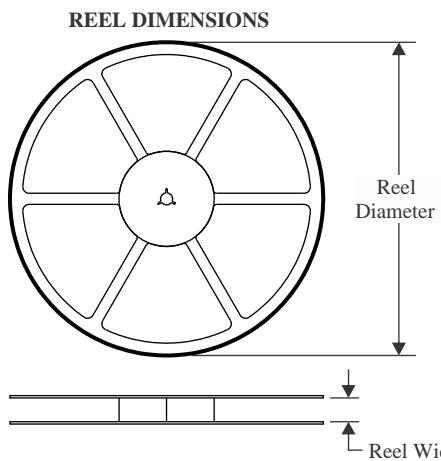
- Catalog : [CD74HC534](#), [CD74HC564](#), [CD74HCT534](#), [CD74HCT564](#)

---

- Military : [CD54HC534](#), [CD54HC564](#), [CD54HCT534](#), [CD54HCT564](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

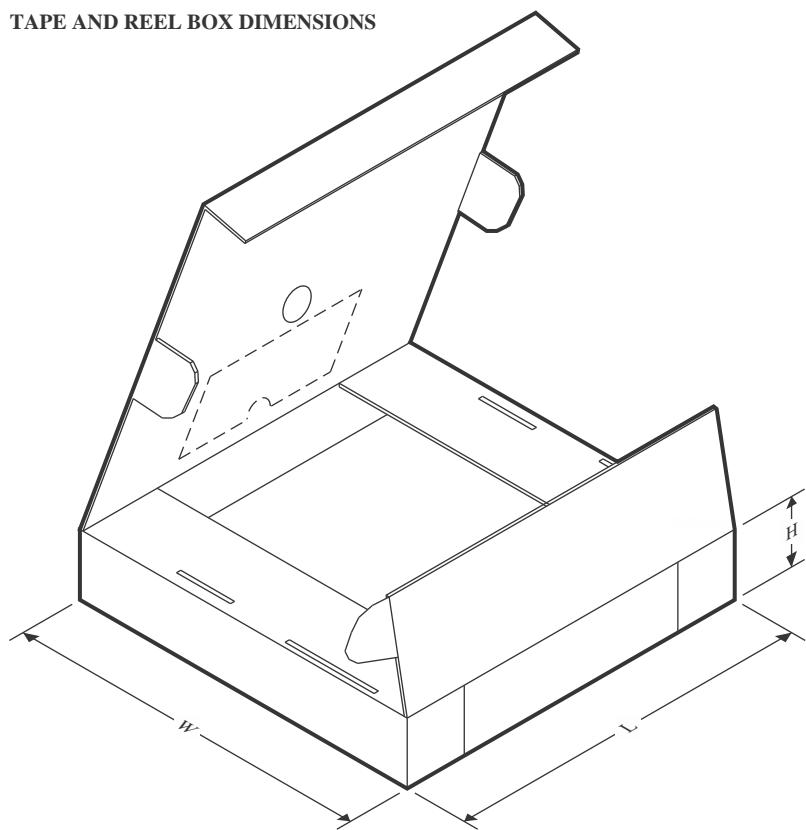
**TAPE AND REEL INFORMATION**


|    |   |
|----|---|
| A0 | Dimension designed to accommodate the component width     |
| B0 | Dimension designed to accommodate the component length    |
| K0 | Dimension designed to accommodate the component thickness |
| W  | Overall width of the carrier tape                         |
| P1 | Pitch between successive cavity centers                   |

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CD74HC564M96 | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.3    | 2.7     | 12.0    | 24.0   | Q1            |
| CD74HC564M96 | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.9    | 13.3    | 2.7     | 12.0    | 24.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CD74HC564M96 | SOIC         | DW              | 20   | 2000 | 356.0       | 356.0      | 45.0        |
| CD74HC564M96 | SOIC         | DW              | 20   | 2000 | 356.0       | 356.0      | 45.0        |

**TUBE**

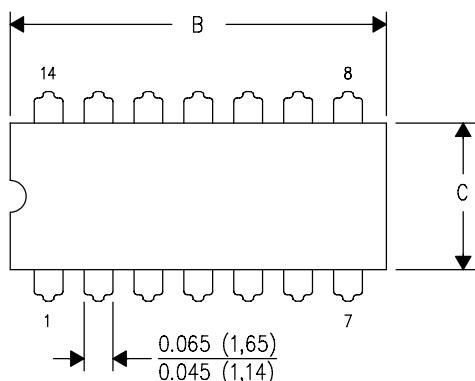

\*All dimensions are nominal

| Device        | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|---------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| CD74HC534E    | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC534E.A  | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC564E    | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC564E.A  | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74HC564M    | DW           | SOIC         | 20   | 25  | 507    | 12.83  | 5080   | 6.6    |
| CD74HC564M.A  | DW           | SOIC         | 20   | 25  | 507    | 12.83  | 5080   | 6.6    |
| CD74HCT534E   | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT534E.A | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT564E   | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT564E.A | N            | PDIP         | 20   | 20  | 506    | 13.97  | 11230  | 4.32   |
| CD74HCT564M   | DW           | SOIC         | 20   | 25  | 507    | 12.83  | 5080   | 6.6    |
| CD74HCT564M.A | DW           | SOIC         | 20   | 25  | 507    | 12.83  | 5080   | 6.6    |
| CD74HCT564MG4 | DW           | SOIC         | 20   | 25  | 507    | 12.83  | 5080   | 6.6    |

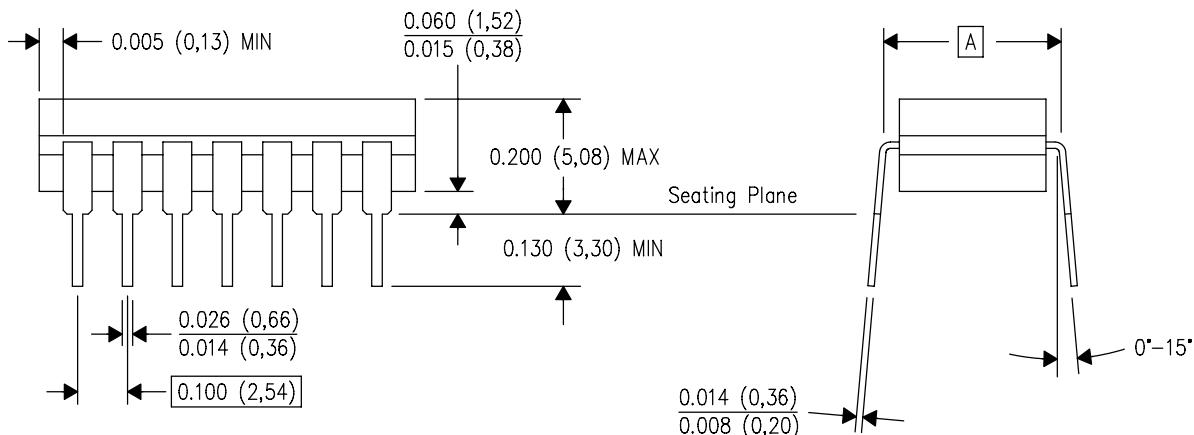
J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



4040083/F 03/03

NOTES: A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.  
C. This package is hermetically sealed with a ceramic lid using glass frit.  
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.  
E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.

△ Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).

△ The 20 pin end lead shoulder width is a vendor option, either half or full width.

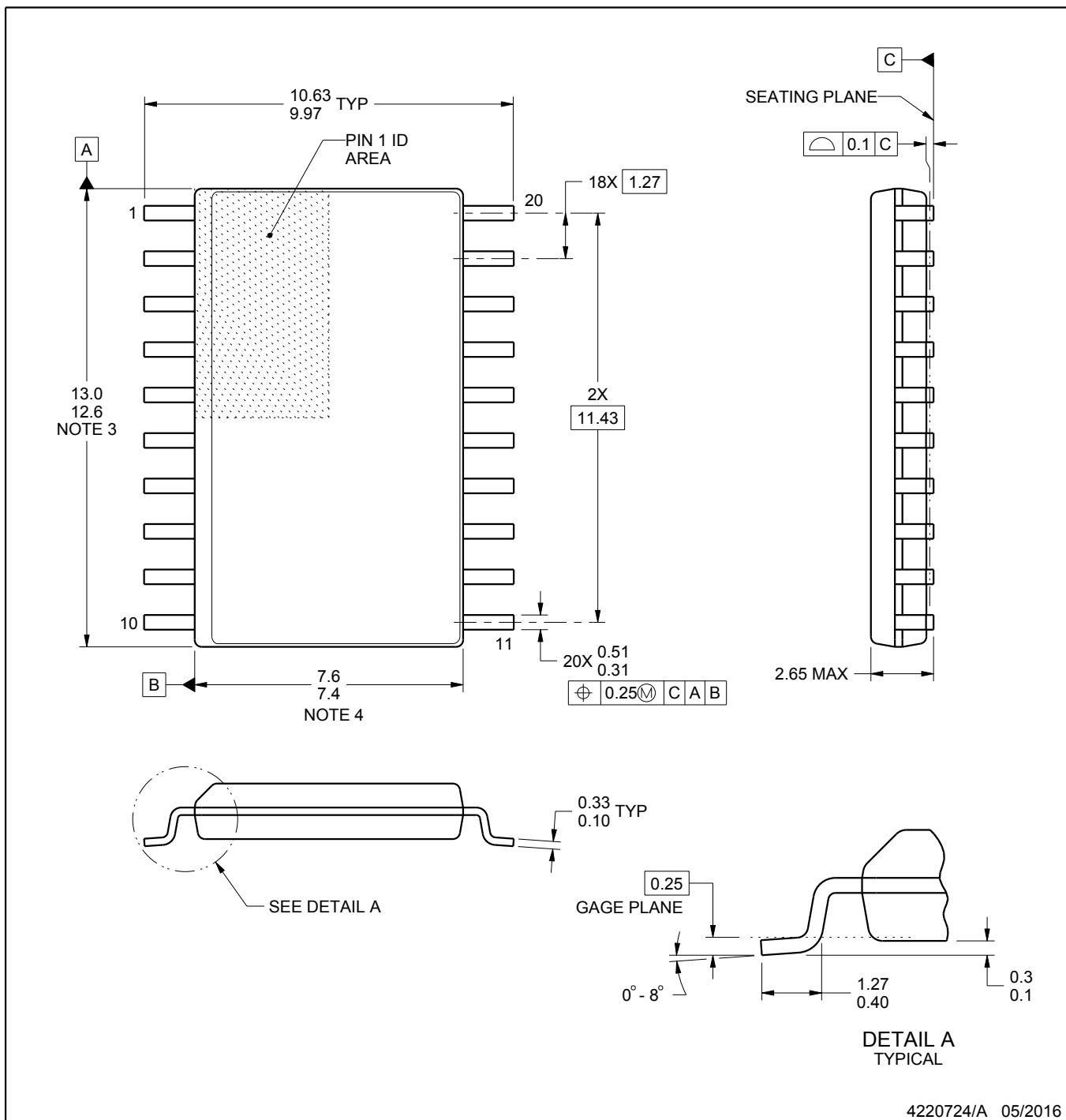
# PACKAGE OUTLINE

DW0020A



SOIC - 2.65 mm max height

SOIC



NOTES:

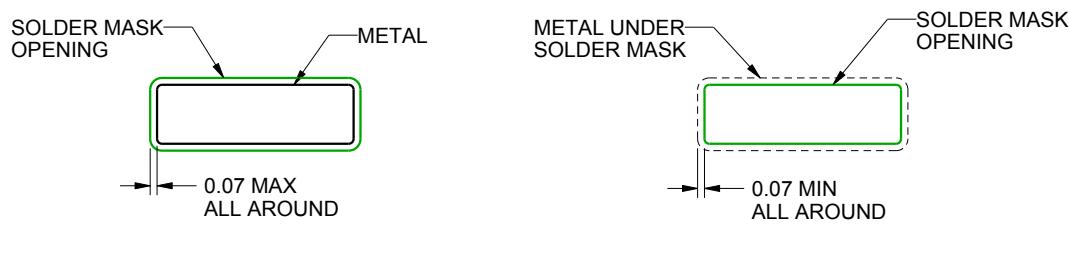
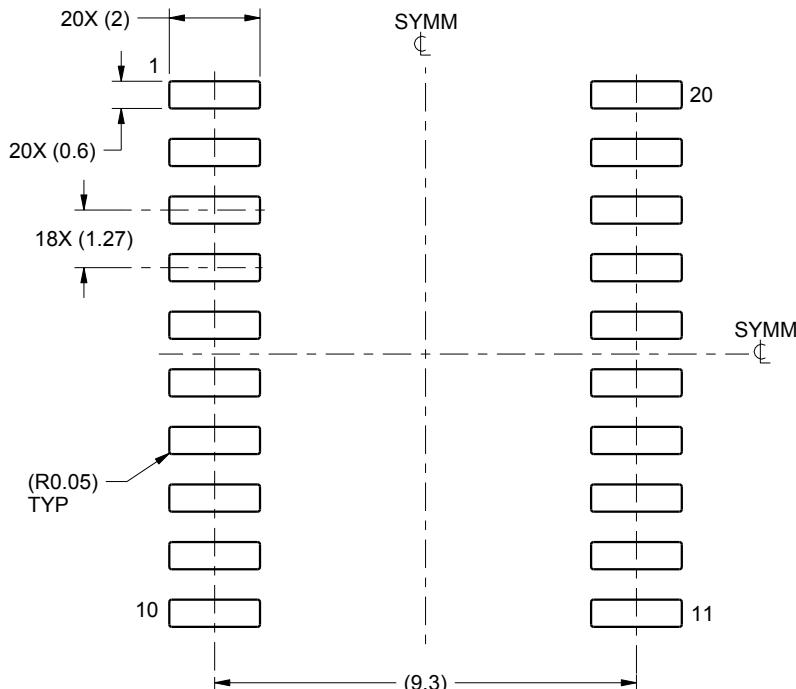
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

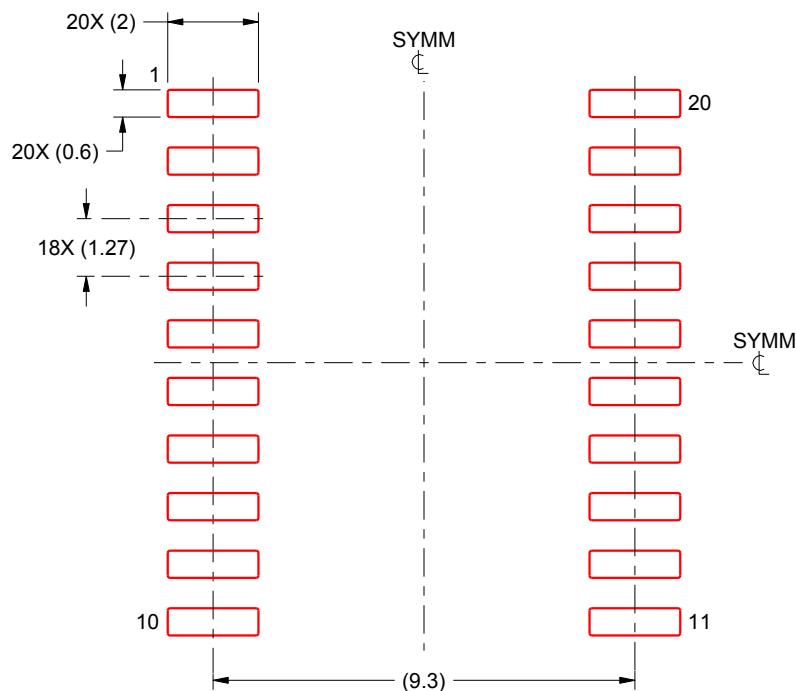
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2026, Texas Instruments Incorporated

Last updated 10/2025